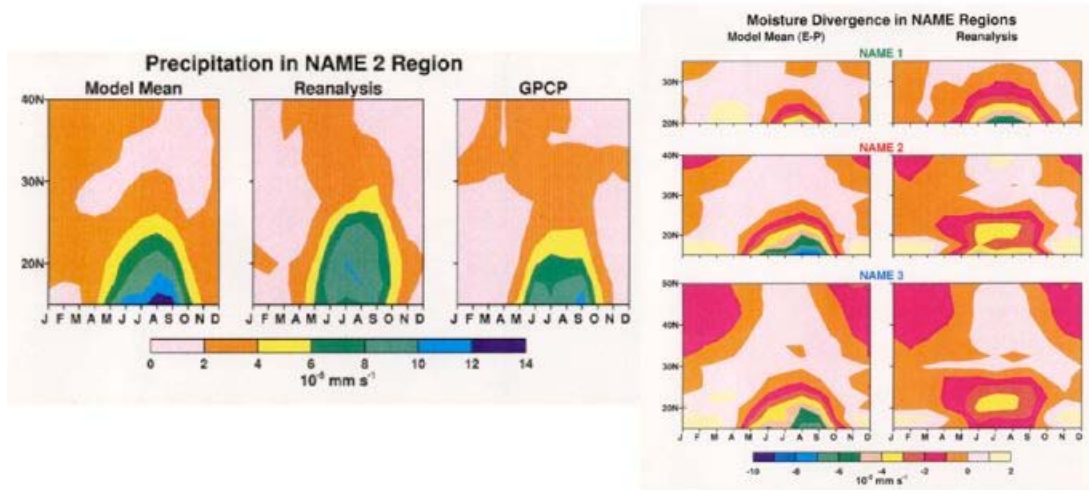


The Moisture Cycle During the North American Warm Season as Simulated in General Circulation and Regional Models

Figures:

General circulation model results in NAME regions





A31A-05. Moisture parameters from models and analyses for NAME



David A. Salstein and Karen Cady-Pereira

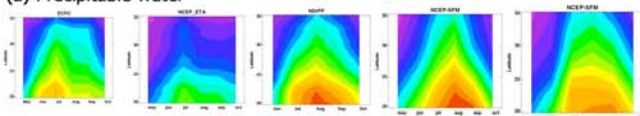
Atmospheric and Environmental Research, Inc., Lexington, MA (salstein@aer.com)

Joint Assembly, Acapulco Mexico, May 2007

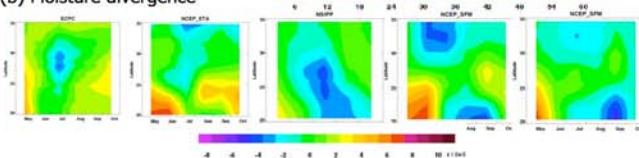
ABSTRACT. We analyzed surface total column parameters, including evaporation, precipitation, precipitable water and water vapor fluxes and divergence, during the warm season (May-October) of two focus years (1990 and 2004) over the North American Monsoon Experiment region, i.e., SW United States and NW Mexico. We compared the calculated values of these parameters, as well as the total moisture budget, from the regional models that participated in the NAME Model Assessment Project in 1990, and with results from the CAM3 model, with higher resolution, in 2004. We also considered North American Regional Reanalysis results in both focus years. We noted considerable differences in precipitation, water vapor divergence, and direction of moisture transport vectors over the North American Monsoon region in these two years. The NARR results also identified the characteristics of the moisture seasonal variability, and some high frequency signals within it, including the role of the Sea of Cortez/Gulf of California in the moisture budget. CAM results revealed seasonal and diurnal progression of moisture parameters.

NAMAP-1 results (NAME Tier 1) - 1990 -- To show spread in atmospheric

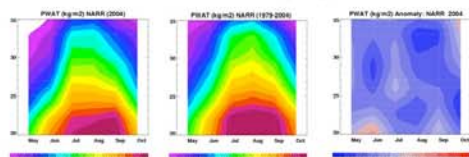
(a) Precipitable water models, monthly values



(b) Moisture divergence



2004 precipitable water and anomaly from long-term mean (NARR analyses).

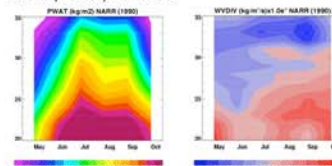


The warm-season in 2004 has less precipitable water than the long-term mean throughout most of the NAME region.

North American Monsoon Experiment (NAME)

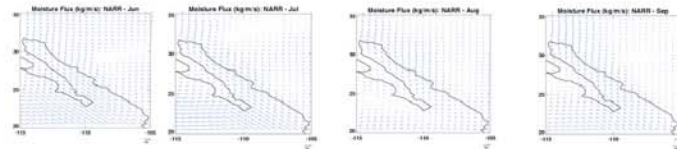


Available NAMAP-1 models for 1990 are given to the left. For the different models' NAMAP simulations, we show the vertically integrated moisture and moisture divergence, averaged over longitudes in the NAME-1 region. Significant differences occur among models, as well as with the North American Regional Reanalysis results, below, for 1990.

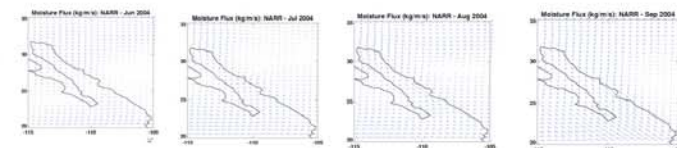


Monthly moisture fluxes - 1990, 2004 - NARR and CAM3

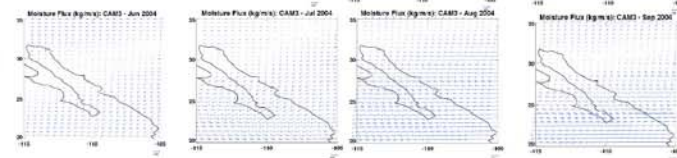
1990 - NARR



2004 - NARR



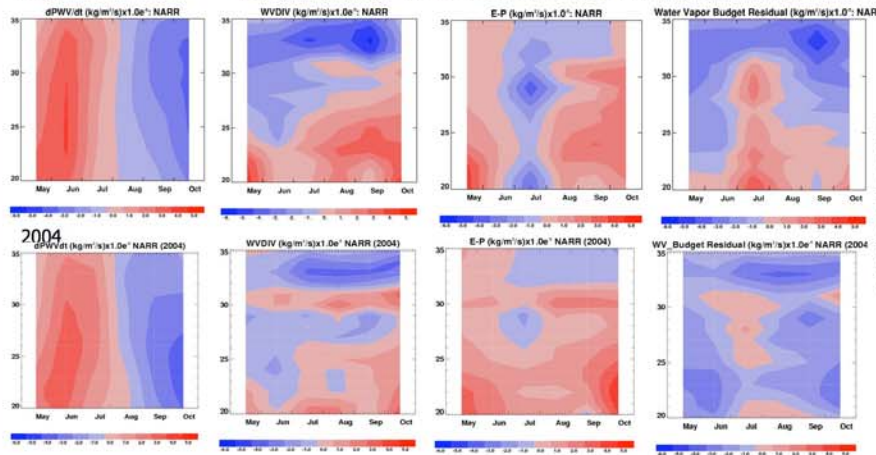
2004 - CAM3



The origin of the moisture in the NAME area is generally from the Pacific, with fluxes directly along the Gulf of California (Sea of Cortez) in some months. The flow was weaker in 2004 than 1990 during June and July, but stronger in August (NARR). The CAM3 results for 2004 are considerably stronger than in NARR and with a larger zonal component.

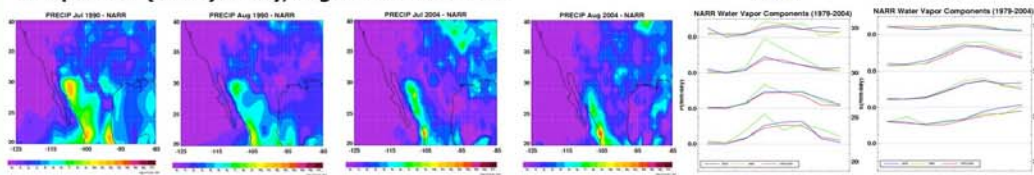
1990

Budget components for 1990 and 2004 in the NAME-1 region



Water vapor budget residual is computed from storage change, water vapor divergence, and evap-precip. The budget residual is maximum in July 1990 across latitudes south of 32, as well as further north in Aug and Sep., but of opposite sign.

Precipitation (NARR) in July, August 1990 and 2004

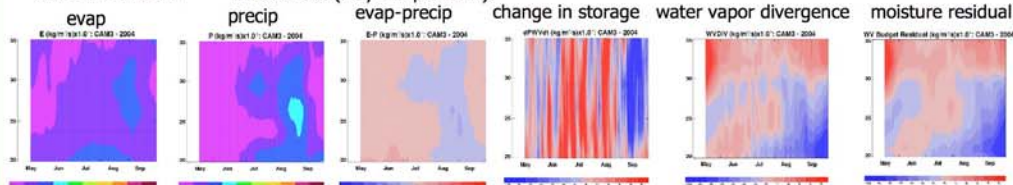


PRECIP is maximized in July, in 1990, with a center as far north as 30 degrees, but is weaker in 2004.

Strong 1990 July PRECIP is evident. EVAP appears to be largest in August-October in both years after the ground has absorbed moisture.

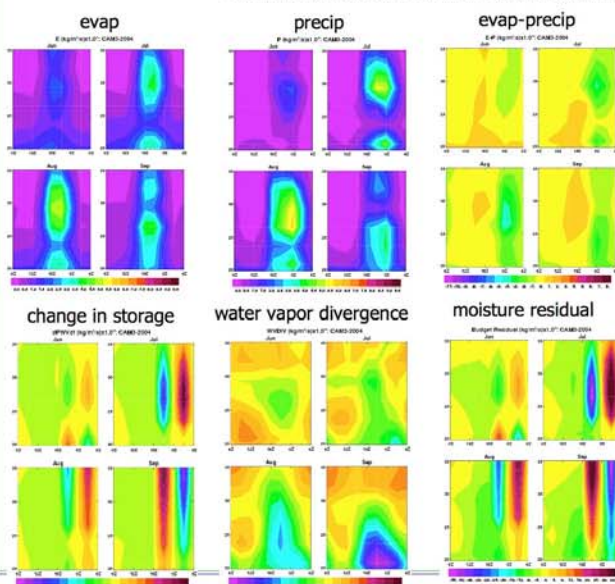
CAM3 results:

1. Seasonal (May - September):



Evap and precip maximize late Aug.- early Sept. Change in storage is smaller with high temporal variability. Water vap divergence progresses through season. Moisture residual is large, generally neg. in south and pos. in north.

2. Diurnal (hours are UT; with 10PM-midnight local time, at left):



Evap. and precip. become stronger in the late afternoon/early evening. Change in moisture storage is relatively large between these hours, leading to high-frequency moisture residual signals. Water vapor divergence has largest signal (negative) in Sept. in the low latitudes.

Acknowledgment to NOAA Grant NA03OAR4310086 under the Climate Prediction Program for the Americas (CPPA)

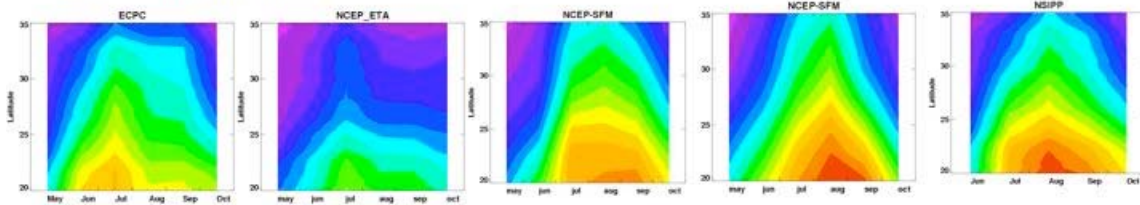
The moisture cycle during the North American warm season as simulated in general circulation and regional models

David Salstein Atmospheric and Environmental Research, Inc.

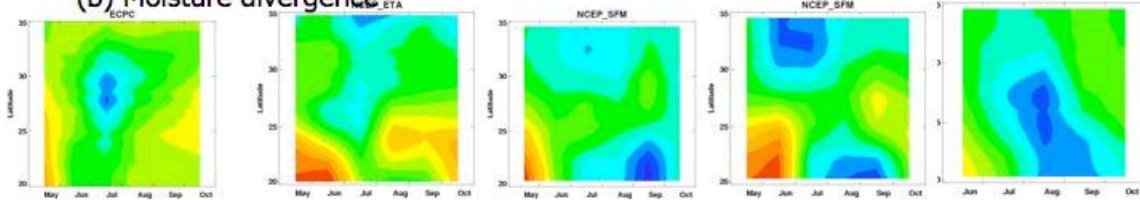


NAMAP-1 results (NAME Tier 1) - 1990 -- To show spread in atmospheric models, monthly values

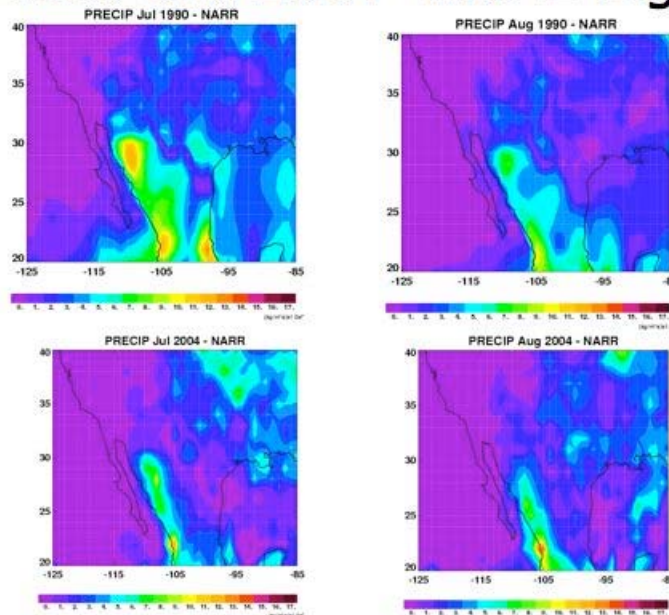
(a) Precipitable water



(b) Moisture divergence



Precipitation (NARR) in July, August 1990 and 2004--NAME region



PRECIP is maximized in July, in 1990, with a center as far north as 30 degrees, but weaker in 2004.